

**CLAIMS**

What we claim as new and desire to secure by Letters Patent is:

- 1        1. An antenna apparatus comprising:  
2                a circuit board comprising a plurality of offset bent-dipole antenna  
3 elements, and  
4                a quarter-wave sleeved balun and coaxial cable feed assembly  
5 connected to said circuit board.
  
- 1        2. The antenna apparatus according to claim 1, wherein said circuit board  
2 includes inductive and capacitive elements.
  
- 1        3. The antenna apparatus according to claim 1, wherein:  
2                said plurality of offset bent-dipole elements comprise a first section  
3 and a second section,  
4                said first section is located on the bottom side of said circuit board,  
5 and said second section is located on the top side of said circuit board and  
6 is substantially perpendicular and capacitively coupled to said first  
7 sections, and  
8                said plurality of offset bent-dipole elements are laterally offset from  
9 each other to create an overlapping of the capacitively coupled elements
  
- 1        4. The antenna apparatus according to claim 2, wherein  
2                said inductive and capacitive elements are in series with a pair of J  
3 shaped elements, and  
4                said pair of J shaped elements are patterned onto the circuit board  
5 in a clockwise direction, wherein, a first J shaped element is starting to the  
6 left and a second J shaped element is starting to the right of said quarter-  
7 wave sleeved balun and coaxial cable feed assembly.

1        5.        The antenna apparatus according to claim 4, wherein  
2                a width of each J shaped element varies in that an area of said pair  
3 of J shaped elements that run parallel to the long axis of said circuit board  
4 is wider than the rest of the element.

1        6. The antenna apparatus according to claim 3, wherein:  
2                said quarter-wave sleeved balun and coaxial cable feed assembly  
3 comprises a quarter-wave length long metal tube placed over said coaxial  
4 cable feed assembly,  
5                said quarter-wave sleeved balun is terminated to the coaxial cable  
6 shield at a point away from said circuit board,  
7                said quarter-wave sleeved balun is left unterminated at the end  
8 closest to said circuit board.  
9                said quarter-wave sleeved balun assembly is angled with respect to  
10 the circuit board at an minimum angle of approximately 55°,  
11                said coaxial cable feed assembly shield is terminated to the bottom  
12 side of said circuit board at the center of said bent dipole elements, and  
13                said coaxial cable feed assembly center conductor passes through  
14 the dielectric of the circuit board and is terminated to said J shaped  
15 elements through said inductive elements.

1        7. A method for tuning an antenna apparatus comprising the steps of:  
2                creating an circuit board comprising a plurality of offset bent-  
3 dipole antenna elements,  
4                patterning a first section of said plurality of offset bent-dipole  
5 antenna elements on the bottom side of said circuit board and a second  
6 section of said plurality of offset bent-dipole antenna elements on the top  
7 side of said circuit board so that said second section is substantially  
8 perpendicular and capacitively coupled to said first sections,  
9                forming said second section of said plurality of offset bent-dipole

10 antenna elements as a pair of J shaped elements that are patterned onto said  
11 circuit board in a clockwise direction, wherein, a first J shaped element is  
12 starting to the left and a second J shaped element is starting to the right of  
13 said quarter-wave sleeved balun and coaxial cable feed assembly, and  
14 configuring said J shaped elements such that a width of each J  
15 shaped element is wider in that an area of said pair of J shaped elements  
16 that run parallel to the long axis of said circuit board.

1 8. The method for tuning an antenna apparatus according to claim 7,  
2 further comprising the steps of removing the metalization on the open end  
3 of said J shaped elements to electrically shorten said offset bent-dipole  
4 antenna elements.

1 9. The method for tuning an antenna apparatus according to claim 7,  
2 further comprising the step of removing the metalization on the squared-  
3 off ends of said offset bent-dipole antenna elements to electrically shorten  
4 said offset bent-dipole antenna elements.

1 10. The method for tuning an antenna apparatus according to claim 7,  
2 further comprising the step of removing the metalization on said wider  
3 area of said J shaped elements to electrically lengthen said offset bent-  
4 dipole antenna elements.

1 11. The method for tuning an antenna apparatus according to claim 7,  
2 further comprising the step of adding metalization to the squared off ends  
3 of said offset bent-dipole antenna elements to electrically lengthen said  
4 antenna apparatus.

1 12. The method for tuning an antenna apparatus according to claim 7,  
2 further comprising the step of varying the thickness of the circuit board,

3        wherein:

4                a thinner circuit board causes the antenna apparatus to be

5        electrically longer, and

6                a thicker circuit board causes the antenna to be electrically shorter.

1        13. A method of manufacturing an antenna apparatus comprising the steps  
2        of:

3                creating an circuit board comprising a dielectric substrate and

4        inductive and capacitive elements,

5                forming a feed assembly from a single coaxial cable with a quarter-  
6        wave sleeved balun assembly,

7                forming a one piece antenna apparatus plastic shell,

8                positioning a plastic cap as the top of said antenna apparatus plastic  
9        shell,

10               placing said circuit board within said antenna apparatus plastic  
11        shell just below said plastic cap, oriented in the horizontal plane,

12               bonding a metal baseplate to the bottom of said antenna apparatus  
13        plastic shell,

14               connecting said feed assembly to said circuit board and terminating  
15        said feed assembly with a connector at said metal baseplate, and

16               injecting a foam material to fill said antenna apparatus plastic shell  
17        and allowing said foam material to encapsulate the upper surface of said  
18        circuit board.

1        14. The method of manufacturing an antenna apparatus as recited in claim  
2        11 further comprising the step of:

3                selecting a pair of inductive elements such that said pair of  
4        inductive element are substantially identical, and

5                selecting a pair of capacitive elements such that said pair of  
6        capacitive are substantially identical.

1        15. The method of manufacturing an antenna apparatus as recited in claim  
2        11 further comprising the step of creating said circuit board to be  
3        approximately 1/16" thick FR4 plated on both the top and bottom.

1        16. The method of manufacturing an antenna apparatus as recited in claim  
2        11 further comprising the step of selecting said foam material with respect  
3        the affect on tuning said antenna apparatus.

17. The antenna apparatus according to claim 1, wherein said circuit board  
is elliptically shaped.